# **Determining Maximum Water Age For Selecting DBP Sample Sites**

Public water systems (C, NTNC) must sample for disinfection byproducts (DBPs) at the place(s) where the water has been in the distribution system for the longest time. These locations are called the maximum water age or maximum detention time locations. It can be difficult to determine where the maximum water age is in a complex distribution system.

The reason that DBP samples must be taken at the maximum water age is that the DBPs increase the longer that chlorine (or chloramine) is in contact with the water. DBPs form when naturally occurring organic carbon reacts with the disinfectant.

#### **Far Reaches of the System**

The first place one thinks of for longest water age is the place farthest away from the water plant. Often this really is the place with the longest water age, especially if there is an area with few residents who don't use much water.

#### **Unbuilt Subdivisions**

When a city expands, it sometimes takes a while for housing to be built in new subdivisions. If a large diameter main has been put in to serve the eventual needs of a new area, it may be a lot bigger than the new subdivision needs at first. When that happens, the water may sit stagnant in the pipe, since there aren't enough people living there to keep the water flowing. An area like this could be close to town, or close to the well, but could still have the oldest water in the system.

#### **Flushing Locations**

Systems often know the areas of the system where they have the most customer complaints about the water, where they have to go out and flush frequently. A location like this could be the place where the water is sitting stagnant for the longest time in the system. When water sits stagnant, the chlorine decays and also forms DBPs. Flushing locations like this are often where the system knows it has trouble maintaining a chlorine residual.

#### **Distribution System Disinfectant Mapping**

One very good way to figure out the maximum water age at a system is distribution system disinfectant mapping. Public water systems in Texas are required to monitor the disinfectant residual weekly (<750 customers) or daily (>750 customers. Even the smallest community is required to have at least five sites where they measure disinfectant. The location(s) where the disinfectant residual is lowest may be the places with the maximum water age. One note - this is not true if there is booster chlorination within the system. Here is an example of how to do chlorine mapping.

### **Example of Distribution System Disinfectant Mapping**

The City of Purchaser measures chlorine at both of their entry points, and at nine places in the distribution system. They have done this for many years. They are going to use their data from the most recent year to figure out where the maximum water age is in their system.

Here is a table that summarizes the City's data. Sample sites EP002 and EP003 are their two active entry points: the City of Wholesaler and Verde River Water Authority, respectively. The letters correspond to locations on the City's distribution map, which is part of their Monitoring Plan. They only monitor the entry point residual Monday through Friday, because entry point monitoring is not required by TCEQ. However, they have to monitor in the distribution system seven days a week.

2003 Chlorine Data for City of Purchaser

Sample Site	Number of samples taken in 2003	Maximum	Minimum	Average
EP002	260	3.2	2.8	3.1
EP003	260	3.5	2.4	2.8
A	42	3.1	2.7	3.0
В	42	1.4	1.0	1.1
С	42	2.2	1.8	2.1
D	40	1.1	0.3	0.8
Е	40	2.3	1.4	1.9
F	40	2.5	1.9	2.3
G	40	2.1	1.7	2.0
Н	40	3.0	2.3	2.5
I	40	0.8	0.2	0.4

#### **Solution:**

This system must select two sampling sites for DBP monitoring because they have two sources of water. (If they served more than 10,000 people they would have to select more sites.) They must select the maximum water age site for each source.

Based on this data, the City decides that the lowest residual at site **I** represents the longest water age for the water they purchase from the Verde River Water Authority. They select this site for DBP monitoring. The site with the second lowest average chlorine residual is site **D**. They determine that site D also represents their Verde River Water Authority source, so they do not select it for DBP monitoring.

The site with the lowest residual in the area of the distribution served by their other source, the City of Wholesaler, is at site B. They select this as their second DBP monitoring site.

## City of Purchaser Water Utility PWS ID 1234567 Chlorine Mapping for Disinfection Site Selection

